

DRAWINGS ATTACHED.

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## COMPLETE SPECIFICATION.

## Improvements in or relating to Seals for Hydraulic Rams.

We, ETABLISSEMENTS A. MARREL, a French Limited Liability Company, of Rue Pierre Copel, Saint-Etienne, (Loire-France), do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to seals used in hydraulic rams to prevent leaks either along the rod of the ram, or along the cylinder thereof.

It is known in hydraulic rams to use a seal of the type comprising an annular member of U-shaped cross-section the lips of the groove of which bear respectively against the cylinder and against the rod, this U-shaped member being expanded by means of a ring adapted to be forced axially into the annular groove. A seal of this type is described and claimed in the British Patent No. 759,233. The U-shaped member being generally made of a relatively hard material such as a polyamide, whilst the material of the ring is a highly deformable rubber or rubber substitute, it will be understood that a seal of this kind may be rapidly damaged under severe temperature and/or pressure conditions (for example above 100° C. and 3,600 p.s.i.). The combined effects of the unavoidable pressure waves and of the dilatation of the mechanical parts produce a superficial damaging of the ring, the material of which becomes extruded between the rod and its guide.

An object of the present invention is to prevent the above mentioned disadvantages on such hydraulic ram seals, by interposing an appropriate deformable washer between the ring and the side of the seal exposed to the fluid under pressure.

According to this invention a seal for a hydraulic ram comprises an annular mem-

ber made of a hard deformable polyamide having on one side a groove of U-shaped cross-section, the lips of which are adapted to bear respectively against the rod of the ram and against the cylinder thereof; a ring made of a more deformable material such as rubber or rubber substitutes, adapted to be forced into the groove of the said member and having a cross-sectional area slightly greater than the cross-sectional area of the said groove; a resilient washer of polyamide having an arcuate cross-section engaged around the rod with its convex side against the said ring and presenting a determined force fit respectively on the said rod and on the inner wall of the cylinder; and means for exerting on the said washer such an axial pressure that it forces the ring into the U-shaped annular member the lips of which are urged into fluid-tight contact with the rod, the said washer retaining its arcuate form under normal conditions, but being able to flatten temporarily thus protecting the said ring against exaggerated stresses.

The annular member, the ring and the washer associated therewith may be disposed between a shoulder provided on the inner periphery of the cylinder of the ram and a metallic annular bushing screwed into the said cylinder.

In the annexed drawings:—

Fig. 1 is a partial longitudinal section showing a seal according to the invention before axial compression.

Fig. 2 illustrates the seal in operative position under normal conditions.

Fig. 3 is a similar view corresponding to a temporary over-compression of the ring.

Fig. 4 is a partial axial section of the washer.

In Figs. 1, 2 and 3 reference numeral 1 designates the rod of a hydraulic ram and reference numeral 2 the cylinder thereof.

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The internal diameter of the cylinder 2 is slightly greater than the external diameter of the rod 1, as indicated at 2a, except for the end of the cylinder 2 which is bored at a larger diameter, as illustrated at 2b, and on the shoulder which separates portions 2a and 2b there is disposed a flat ring 3 of bronze, cast iron, steel or other relatively hard and rigid material. On this ring 3 rests a washer 4 (Fig. 4) made of a polyamide and having an arcuate cross-section. Said washer 4 has a force fit onto the rod 1 and into the cylinder 2. On the washer 4 is disposed a highly deformable ring 5 of rubber or like deformable material, the said ring being in the form of a torus with the innermost diameter substantially smaller than the internal diameter of the portion 2b of the bore of the cylinder 2. On this ring 5 is located a sealing annular member 6 made of a hard deformable polyamide. The annular member 6 is rectangular in cross-section and its lower face is formed with a deep annular groove 7 of substantially semi-circular profile.

The upper end of the portion 2b of the bore of cylinder 2 is threaded and it receives a threaded metallic end bushing 8.

When the end bushing 8 is screwed down, the annular member 6, the highly deformable ring 5 and the washer 4 are compressed axially whereby the highly deformable ring 5 is driven into the groove 7, whilst the washer 4 retains its arcuate form (Fig. 2) thanks to its own relative rigidity and to its force fit. The ring 5 is then caused to fill up the groove 7 of the annular member 6, the two lips of which are thus pressed respectively against the rod 1 and the wall of the part 2b of cylinder 2.

There is thus obtained a perfectly fluid-tight seal, allowing a good operation of the ram under the most different pressures.

If in operation unusually high pressures are developed onto the highly deformable ring 5, owing to a local overheating, pressure shocks or like secondary phenomena, it will be understood that the reaction of said ring 5 onto the resilient washer 4 increases. Said washer 4 thus flattens progressively which has for a result that the pressure which it exerts on the rod 1 and on the wall of the ram cylinder 2 increases correspondingly, thus improving the tightness of the seal and preserving the ring 5 from being damaged by

pressure shocks. This distortion of the washer 4 may even bring it to the conformation illustrated in Fig. 3, where said washer is temporarily flat and applied against the upper face of the metallic ring 3.

As soon as these unusual conditions disappear, the washer returns to its original arcuate form, under the action of its own resiliency and the seal is again at its normal operating position, as illustrated in Fig. 2.

#### WHAT WE CLAIM IS:—

1. A seal for a hydraulic ram, comprising an annular member made of a hard deformable polyamide having on one side a groove of U-shaped cross-section, the lips of which are adapted to bear respectively against the rod of the ram and against the cylinder thereof; a ring made of a more deformable material such as rubber or rubber substitutes, adapted to be forced into the groove of the said member and having a cross-sectional area slightly greater than the cross-sectional area of the said groove; a resilient washer of polyamide having an arcuate cross-section engaged around the rod with its convex side against the said ring and presenting a determined force fit respectively on the said rod and on the inner wall of the cylinder; and means for exerting on the the said washer such an axial pressure that it forces the ring into the U-shaped annular member, the lips of which are urged into fluid-tight contact with the rod, the said washer retaining its arcuate form under normal conditions, but being able to flatten temporarily thus protecting the said ring against exaggerated stresses.

2. A seal as claimed in Claim 1, wherein the annular member, the ring and the washer associated therewith are disposed between a shoulder provided on the inner periphery of the cylinder of the ram and a metallic annular bushing screwed into the said cylinder.

3. A seal for a hydraulic ram, substantially as herein described and as illustrated in the accompanying drawings.

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